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MOUNTING MEDIA OF HIGH REFRACTIVE INDEX.

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At the Rochester meeting, last year, I described, as published in the Proceedings, a medium of high refractive index, for mounting diatoms, especially tests: a compound of arsenic and antimony. I regret to say that nearly all the mounts that I have made in this medium have "gone to the bad," only about half a dozen remain unchanged; some of these are two years old, and one has never had a protecting ring, the mount being under an irregularly-shaped cover. I mentioned, at that time, that I was not ready to make known the composition of a still higher refractive medium, with which I was yet experimenting. I did not choose to say much about it until I was satisfied I could make permanent mounts, or at least had done the best I could with it. In this reticence, or rather, reluctance "to rush into print" (for I did make the whole known to several microscopists), I have been taken to task by the editor of the *Journal of the Royal Microscopical Society*, and some scarcely courteous insinuations were indulged in. I care as little for these as any one possibly can. I have not been influenced by them to say something before I was ready to say it, or had fully made up my mind what to say; nor did I care to take the chances of having some one else develop the process, and have it published as a well known old English discovery, sharing the fate of the "vertical illuminator" now advertised everywhere as "Beck's," when the first one ever seen in England was shown to Messrs. Beck & Powell, sent over by me for this purpose. Both of these gentlemen took out patents for what they deemed an improvement, a glass reflector, which was really what I had used in the first form in which I had made it, as fully described in *Silliman's Journal*, and had abandoned as inferior to the metallic reflector. I may remark that Powell &

Leland made a handsome recognition of my connection with this invention. My experience with this, and some other similar experiences, has made me cautious, perhaps wrongly; and while many friends, and among them Dr. Van Heurck, have been working with the new media, and kept fully informed of my own experiments, I have not hitherto been ready to publish anything, and especially as I was reserving what I might have to say for presentation here.

I have entirely abandoned the arsenic-antimony medium, and think I have discovered another much better one, which gives quite colorless mounts, is much cheaper, and more readily made. I will give the formula for this:

A stiff glycerine jelly is first made, about the consistency of honey, by dissolving clear gelatine (Cox's, or, the so-called photographic gelatine) pure glycerine, by aid of heat, and, in two fluid drachms of this, forty grammes of pure stannous chloride are dissolved. The solution is easily effected by a little heat. When this solution is made it will probably be somewhat milky, but by boiling it in a test-tube it will become beautifully clear, and about the color of balsam. This boiling must be done in a test-tube not over $\frac{1}{4}$ full, as the bubbles are, towards the last, very large, and thrown violently up and liable to eject the fluid from the tube; but with care the whole may, in a short time, be made not only clear, but, when cold, about as stiff as thick balsam; and, if in a small vial, it is not readily poured out. This medium should be used in making mounts precisely as balsam is when the mounts are to be finished by heating. The bubbles escape very rapidly and easily, but towards the end of the boiling, as the medium becomes viscid, they are inclined to persist, but by carefully heating, using a small flame, they will disappear, and, indeed, as they are mostly steam, they will frequently disappear wholly in cooling, when a balsam mount under the same circumstances would be full of bubbles.

If the boiling has been sufficiently prolonged, the cover will be found to be pretty firmly attached, when the slide is cold, and the excess of material can be cleaned off without danger to the mount—indeed, this excess should be hard, requiring a knife or a sharp edge to remove it. It is advisable to put on only so much of the medium as is necessary to fill in under the cover, and have no cleaning to do

afterwards; in other words, put on a minute drop, and if that should not be enough, feed in a little more from the end of the small glass rod used for dipping. The best thing to clean off the excess is hydrochloric acid—a bit of tissue paper rolled up and moistened with this, not too wet, serves the purpose admirably, but water may also be used, and is nearly as good.

As the medium is deliquescent, it is necessary to use a protecting ring. For this purpose, after the slide is well cleaned around the cover glass, and warmed to dry it, apply a good coat of zinc-white cement, or shellac, colored to suit the fancy. If the sealing is perfect there will be no change by time. It is recommended, however, to use a wax ring. These rings, punched out of sheet wax, of such size as to cover the edge of the thin glass, are put on the mount when it is finished, and, by cautious application of a small flame, just melted, *but not so as to run*. If any bubbles form under the ring, they may be removed by touching with a hot needle or pin-point before the wax cools. A mount made this way will stand indefinitely; it will bear any amount of rubbing, and may be polished by friction with the palm of the hand, and can, at any time, receive a supplemental colored ring of shellac or other varnish for a finish. *Amphipleura pellucida* is very beautifully shown in this medium, and the various Pleurosigmas—indeed, all diatoms except the very coarse ones, which appear almost black in the medium. A very little experimenting will enable one to use the medium successfully.

The use of the gelatine is only to give such a hold upon the cover as will permit the necessary pressure in cleaning. Many mounts have been made, both by myself and others, in the earlier experiments with this medium, without the gelatine, but in all these cases the cover was less firmly attached to the slide. If the protecting ring keeps out moisture from immersion media, or the atmosphere, the mounts will remain unchanged. As the medium dissolves gelatine, albumen, etc., arranged diatoms must be fastened to the cover by heating the latter, supported on a bit of thin sheet-iron or platinum, nearly to the melting or softening point. A larger proportion of the stannous chloride can be dissolved than that mentioned above, even as much as sixty grammes, but then, on heating to

harden the mass, crystals will appear; the crystals never give any trouble when forty to fifty grammes are used.

The second medium, which is the well-known yellow one, is realgar (the transparent sulphide of arsenic), dissolved in bromide of arsenic by aid of heat. Both of these substances should be pure, and the mount should be boiled as long as bubbles are readily given off, by the application of considerable heat, and when cold the cover should be more firmly attached than with balsam. These mounts are of a deep lemon-yellow color, and the compound has a refractive index of 2.4. Excellent, and even better mounts, as to permanence, may be made by sublimation. A bit of the realgar is put on a plate of mica about one inch square, and thick as a penny. This is melted by strong heat of a spirit-lamp. On this mica plate is placed another, with a hole $\frac{5}{8}$ of an inch in diameter, and above this a thin glass plate with a hole slightly less than the glass cover on which the diatoms are mounted. In

the figure, *a* and *b* are the two mica plates, *c* the glass plate, and *d* the cover, with the diatoms facing the realgar. The whole is now supported on a metal ring. A strong heat will volatilize the realgar without change, and often a clear deposit is made all over the diatoms and under side of the cover, and the latter can now be mounted in balsam; but, if bubbles are formed in the operation, as probably will be the case, the heat must be continued till these disappear, and, as the deposit will now be thickest at the center, just over the realgar, the mount may be finished by putting the cover, realgar side down, on a clean slide, and on top of it, to prevent breaking, a piece of thick glass, and then, grasping tightly with forceps to give pressure, heating strongly over a spirit-lamp. The realgar will soften (it must not be boiled, else bubbles will form which cannot be removed) and spread out, more or less, between the cover and slide, making a nice, clear mount. The color of the heated realgar is very much deeper than when cold. Instead of the solid realgar, which is liable to crack on cooling, a drop of the solution in bromide of arsenic may be used, but in this case it must be boiled to expel the most of the bromide, before the cover is placed above it; the solid compound now melts at a much lower temperature than the realgar alone. These mounts



will not change, but those made from the solution, directly, will, if the ingredients are not entirely pure, containing no excess of either sulphur or arsenic.

Dr. Allan Y. Moore is an independent discoverer of the value of realgar as a medium for test-diatoms, though, owing to its high melting point, he has not been able to make satisfactory mounts with it. I am informed by Dr. Van Heurck, to whom I gave the formula some time ago, that, with materials prepared for him by Rosseau, of Paris, he had no trouble in making excellent and permanent mounts. As bromide of arsenic will dissolve both sulphur and arsenic, there is always danger, if the realgar is not pure, that there will be an excess of one of these, and if so, the mount will either crystalize or granulate. I had great difficulty in getting the realgar; indeed, it could not be found in New York, and I was obliged to make it; but I have recently received a pretty large supply, purified by sublimation, from Rosseau, Paris, and also of the bromide of arsenic, and shall be glad as long as any remains to share it with any one desiring to experiment.

NOTE.—Since the preceding was written, I have found that bromide of antimony may be added to the forty gramme solution of stannous chloride in considerable quantity, thereby increasing the refractive index nearly to 2. If too much should be added so that crystalization occurs in cooling, or by long standing, a slight addition of the forty gramme solution will remedy this. The bromide of antimony alone, dissolved in the glycerine jelly, makes a medium of still higher index, and seems to work very well; of course it is brought as near to saturation as possible.